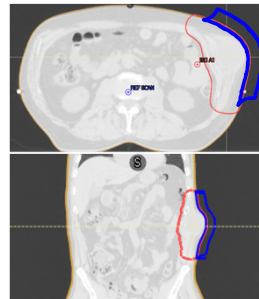


Skin flash versus robust optimization: what is the most appropriate approach for accounting for hypothetical swelling in treatment planning?

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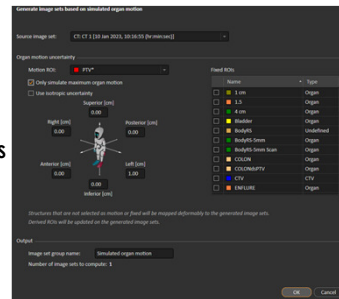
1 INTRODUCTION

Skin flash optimization method



VERSUS

Robust optimization method



Studied sites:

- Inguinal
- Groin
- Flank
- Vulva
- Scrotum
- Knee
- Thigh
- Forearm
- Elbow

Purpose:

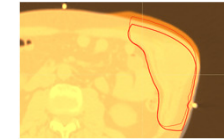
To have a reliable optimization method that accounts for swelling in order to reduce the need for re-scanning and consequently decrease staff workload.

2 MATERIALS AND METHODS

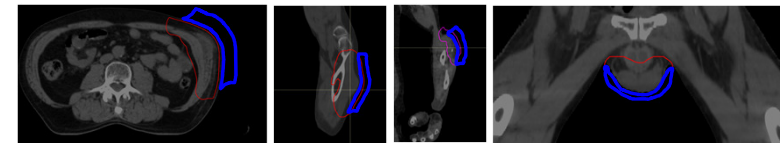
For 52 patients:

- Plan without skin flash
- Plan with skin flash
- Robust plan

Calculated with and without a 1cm swelling simulated on the patients' CT images in the most clinically relevant direction



The skin flash technique consisted of creating a superficial volume on the body surface to simulate swelling. A minimum dose constraint with a weight of 0 was applied to this volume to force MLC leaf opening in the region.



Plan evaluation focused on 100% and 95% prescription dose coverage of 100% of the PTV volume, as well as maximum dose.

3 RESULTS AND DISCUSSION



Figure 1 and 2: PTV coverage difference and maximum dose between the optimization with and without skin flash for groin, knee and thigh treatment.

Figure 1 presents the PTV coverage corresponding to 95% of the prescribed dose, with and without the application of the skin flash optimization method, following a 1 cm swelling, for 15 patients treated in the groin, knee, and thigh regions. The flash optimization method appears to be effective for only one patient (patient 9). For the remaining patients, no statistically or clinically significant difference in PTV coverage is observed between plans optimized with and without skin flash.

Furthermore, as illustrated in Figure 2, the application of flash optimization can increase the maximum dose, with patient 9 showing a significant increase of 30% compared to planning without flash optimization.

4 CONCLUSION

Robust optimization provides substantially better target coverage, and better maximum dose control than skin flash optimization following a 1 cm swelling. Robust optimization should be implemented clinically to reduce the number of patient re-scans and provide plans with better overall maximum dose control.

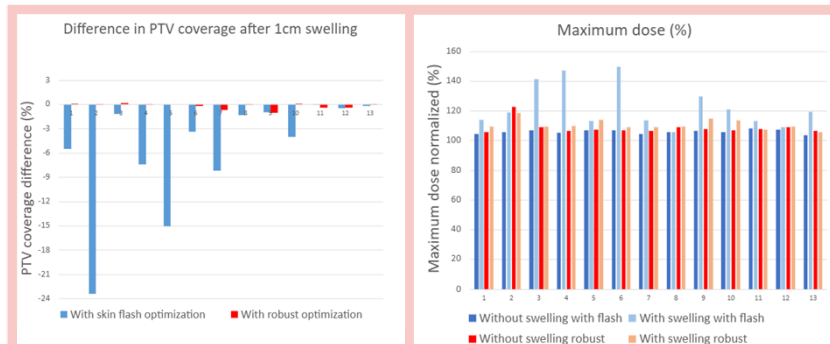


Figure 3 and 4: PTV coverage difference and maximum dose between skin flash optimization and the robust optimization for inguinal, groin, flank, vulva, scrotum, knee, thigh, forearm, and elbow treatment.

Figure 3 illustrates the differences in PTV coverage obtained with skin flash and robust optimization for patients treated in the different anatomical regions mentioned above. The results indicate that, with robust optimization, the PTV coverage remains essentially unchanged following a 1 cm swelling.

Figure 4 further demonstrates that, unlike skin flash optimization, the maximum dose with robust optimization is more controlled following a 1cm swelling. Differences in max dose between the scans with and without swelling are also much smaller in robust optimization compared to flash optimization.